CURRENT STATUS—PROSTHETIC MATERIALS FOR MAXILLOFACIAL RECONSTRUCTION

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INTRODUCTION

A combined clinical service and research program has been in operation for over 1 year. The principal goal is to develop, qualify, and propose standards for prosthetic materials in terms of specifications for tactile qualities and endurance. These qualities are developed from standard stress-strain profiles which approximate those of living, facial tissue, and are clinically evaluated by the molding of actual prostheses for patient trial.

MATERIALS AND TESTS

Following appraisal and assessment of the stress-strain profiles of polyvinylchlorides, polyurethanes, acrylics, and elastomers, all of which have been used in maxillofacial prostheses in the past, we chose as our reference or base biomaterial polysiloxanes or silicone rubber as most commonly known.

TEST METHOD

From the conventional Instron stress-strain profile and durometer coding, the modulus of elasticity for a given material is obtained. This provides a measure for and of the "tactile feel" of this material. The ultimate strength and percent ultimate elongation are also obtained from the Instron stress-strain profile. From the percent elongation for a given material it is determined how to modify the formulation of the chemical components in the silicone prosthesis to achieve the desired softness and anatomical conformation to optimally match a patient's articulate features of mastication, speech resonance, and facial gesture.

RESULTS

The work to date has involved RTV (room temperature vulcanized)

silicones, and HTV (high temperature vulcanized) silicones. The RTV silicones are easy to handle and may readily be used by ordinary technicians in prosthetic reconstruction. The HTV silicones, however, require special tooling, metal molds, blending rolls, and special curing ovens. The stress-strain profile data on RTV and HTV indicate several advantages of the latter.

The tactile feel of RTV and HTV has been extensively modified with low and intermediate molecular weight additives. The HTV compositions mixed with a special catalyst provide considerably higher elongations at low stress, more replicative of anatomical structure, and considerably higher stress at breakage as in tearing.

Research has been done to adapt the HTV chemistry to fit that achievable in the routine prosthodontic treatment service facilities, obviating the need for expensive investment in special tools, molds, curing ovens, etc. The heat cured HTV elastomers are now capable of being made in ordinary dental stone molds rather than expensive specially made metal molds. A full range of tensile, durometer, and tear strength data on the modified HTV elastomers is now being developed, with the expectation that patients' preference and enthusiasm for wearing prostheses of the new compounds will be enhanced.

CLINICAL SERVICE

To date we have provided prostheses for 40 patients as tabulated in Table 1.

TABLE 1

Reconstruction	RTV and combinations	New improved HTV (MDX-series)
Aural	12	—
Orbital	8	—
Ocular	17	—
Nasal	21	—
Complex	3	1
Implant	3	1
Total	64[a]	2

[a] Discrepancy in total patients is due to research duplicate prostheses.